

Removal of Arsenic from Mining Effluent

"ZENON's selective adsorption/microfiltration technology has been shown to be capable of removing arsenic to levels below 0.02 mg/L. This is an order of magnitude improvement over conventional processes and will assist the province in addressing future water quality issues."

R.P. Canning
Manager, Process Engineering
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THE COMPANY

ZENON Environmental Inc. is an advanced technology company which provides a comprehensive range of environmental and engineering services to industries, consultants, and governments. The company currently employs over 200 people in its offices in Canada, the U.S. and Europe. ZENON's head office is located in Burlington, Ontario where over 45,000 square feet of space is dedicated to office, laboratory, pilot plant and manufacturing facilities. ZENON specializes in providing innovative and cost effective solutions to complex problems.

THE CHALLENGE

Groundwater contamination with arsenic is a serious problem in Ontario due to its toxicity and presence in certain regions of the province. Arsenic finds its way into the groundwater when it is leached from arsenic-containing minerals either directly or, as a result of mining activity and surface discharges from the lumber industry (wood preservation chemicals), agricultural chemicals, metal refining, and glass manufacturing industries. In many areas, concentrations of arsenic in groundwater greatly exceeds safe levels. Conventional precipitation based treatment processes which are currently in widespread use in the mining industry and elsewhere are capable of reducing arsenic to levels of approximately 200 ppb.

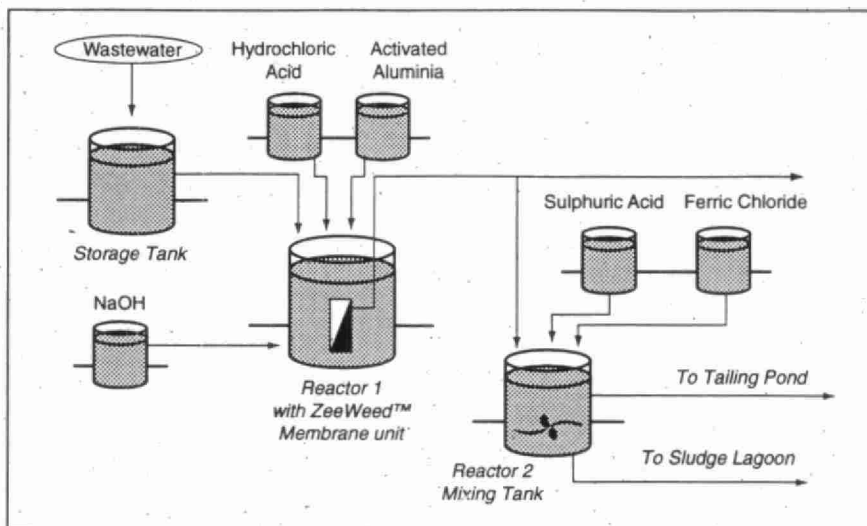


Figure 1 - Schematic of Process Train

Improved technology is required to achieve the enhanced removal efficiencies needed to meet more stringent effluent discharge standards.

Enhanced arsenic removal processes for the treatment of larger volumes of contaminated water must meet the following requirements; a high selectivity towards arsenic, a high processing rate, the possibility of arsenic recovery and low incremental cost. The treatment process which was developed under this project was designed to meet these objectives by combining several existing and well proven processes to produce a hybrid process with enhanced capabilities.

TECHNOLOGY DESCRIPTION

The process train is shown schematically in Figure 1. Contaminated water is mixed with the inorganic sorbent in Reactor 1. Arsenic is adsorbed quickly and completely under favourable conditions. The microfilter which is integrated into Reactor 1, separates the arsenic loaded sorbent from the treated water by allowing arsenic free permeate to pass through the membrane. Once the adsorbent has been fully loaded with arsenic, it is then regenerated in situ in Reactor 1 by adjusting the pH

into the alkaline range. The concentrated arsenic solution which is recovered during adsorbent regeneration is then further processed in Reactor 2 to convert the arsenic to a physical and chemical form which is most suitable for disposal or recycle/reuse.

RESULTS

It has been demonstrated that when selected commercially available aluminas with particle sizes in a range of several microns are used and the pH of adsorption is maintained at about 3, an extremely rapid adsorption of arsenic takes place. As a result, the concentration of arsenic in the effluent can be reduced to 0.02 ppm in less than five minutes.

TECHNOLOGY OPPORTUNITIES

ZENON is seeking candidate sites for on-site pilot testing of the technology. Once a suitable site is identified and the results are validated to the mining industry at a larger scale, the company plans to market this process in North America and Europe.



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PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

The demonstration of this technology was partially supported by the Ontario Ministry of the Environment, and Environment Canada – Emergencies Engineering Division.

Industrial companies located in Ontario may seek ministry/industry services which will help them:

- * reduce, reuse and recycle solid waste;
- * effectively remediate historic pollution and destroy hazardous contaminants;
- * reduce or eliminate liquid effluent and gaseous emissions;
- * use energy and water more efficiently.

Equipment and services supply companies can benefit from the information provided on technologies identified for business development.

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MINISTRY OF THE ENVIRONMENT SERVICES

For information on Ministry of the Environment assistance to industry, please contact the Industry Conservation Branch at (416) 327-1492, Fax (416) 327-1261.

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